Question Banks

Q1: Find the distance between the two points with coordinates (6, 8, 10) and (4, 4, 10)

Answer: $\mathbf{r}_{21}$=4.47 units

Q2: Two vectors form an angle of 11^0. One of the vectors is 20 units long and makes an angle of 40° with the vector sum of the two. Find the magnitude of the second vector and of the vector sum.

Answer: 13.7 units & 20 units

Q3: Vector **B** has *x*, *y*, and *z* components of 4.00, 6.00, and 3.00 units, respectively. Calculate the magnitude of **B** and the angles that **B** makes with the coordinate axes.

Answer: **A**=7.81 & angles: 59.2°, 39.8°, 67.4°

Q4: Find the component of the vector that is 13 units long and makes an angle of 22.6° with the z-axis, and whose projection in xy-plane makes an angle φ of 37° with + x-axis.

Answer: **Vx**=4 units & **Vy**=3 units

Q5: *The vector product in terms of components.* Given the two vectors

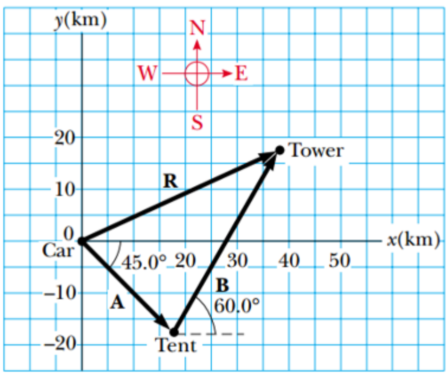
$$\vec{A} = 3\boldsymbol{u_x} + 5\boldsymbol{u_y} + 2\boldsymbol{u_z}\vec{B} = -4\boldsymbol{u_x} + 7\boldsymbol{u_y} + 5\boldsymbol{u_z}$$

Find their vector product.

Answer: $\vec{A} \times \vec{B}$ =11$\boldsymbol{u_x}$ - 23$\boldsymbol{u_y}$ + 41$\boldsymbol{u_z}$

Q6: A hiker begins a trip by first walking 25 km southeast from her car. She stops and sets up her tent for the night. On the second day, she walks 40 km in a direction 60° north of east, at which point she discovers a forest ranger's tower as shown in the figure.

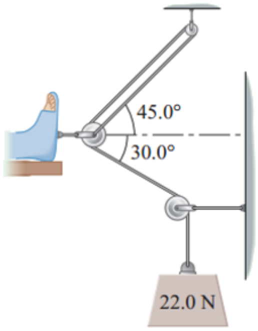
Answer: $\mathbf{R}$ = $(37.7\hat{\mathbf{i}} + 16.9\hat{\mathbf{j}})$ km



Q.7/ If a man weighs 900 N on the Earth, what would he weigh on Jupiter, where the acceleration due to gravity is 25.9 m/s^2?
Answer: $\mathbf{(F)_{on\ Jupiter} = 2377.62\ N}$

Q.8/ A body with a mass of 1 Kg is on smooth plane inclined at an angle of 30° with the horizontal. With what acceleration will the body move if there is a force of 8 N applied parallel to the plane and directed (**a**)upward, (**b**) downward?
Answer: **3.1, 12.9 m/s^2**

Q.9/ In a traction apparatus, three cords pull on the central pulley, each with magnitude 22.0 N, in the directions shown in Figure. What is the sum of the forces exerted on the central pulley by the three cords? Give the magnitude and direction of the sum.
Answer: F=54 N & θ=21.8°



Q10/ A particle moves along the x axis according to the equation $\mathbf{x = 2 + 3\,t + t^2}$, where x is in meters and t is in seconds. At t = 3 s, find (a) the position of the particle, (b) its velocity, and (c) its acceleration.

Q11/ A truck covers 40.0 m in 8.5 s while smoothly slowing down to a final speed of 2.8 m/s. (a) Find its original speed. (b) Find its acceleration.

Q12/ A speedboat moving at 30 m/s approaches a no-wake buoy marker 100 m ahead. The pilot slows the boat with a constant acceleration of -3.5 m/s2 by reducing the throttle. (a) How long does it take the boat to reach the buoy? (b) What is the velocity of the boat when it reaches the buoy?

Q13/ A student throws a set of keys vertically upward to her sorority sister, who is in a window 4 m above. The keys are caught 1.5 s later by the sister's outstretched hand. (a) With what initial velocity were the keys thrown? (b) What was the velocity of the keys just before they were caught?

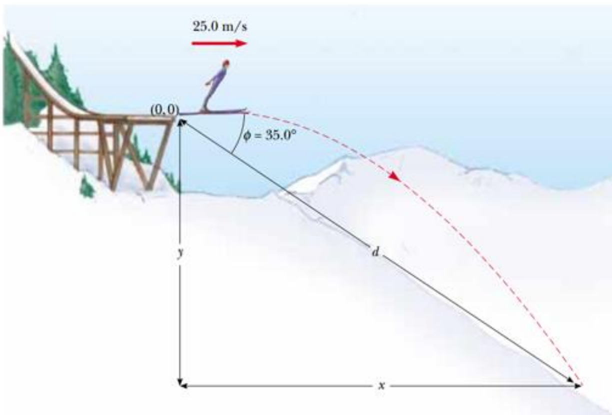
Q14/ A stone falls from a balloon that is descending at a uniform rate of 12 $m.s^{-1}$. Calculate the velocity and the distance traveled by the stone after 10 s. Solve the same problem for the case of a balloon rising at the given velocity.

Q15/ An automobile, starting from rest, reaches 60 km hr^{-1} in 15 s. (a) calculate the average acceleration in m min^{-2} and the distance moved (b) assuming that the acceleration is constant, how many more seconds will it

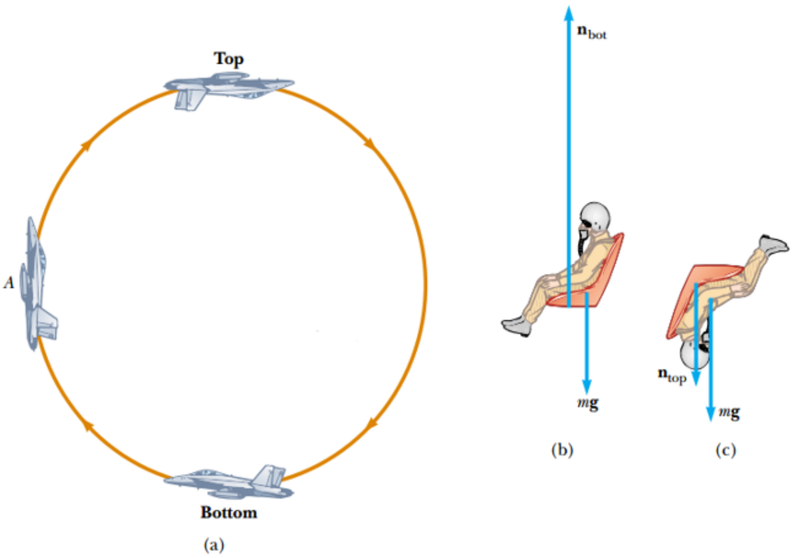
take for the car to reach 80 km hr^{-1}? What has been the total distance covered?

Q16/ At $t = 0$, a particle moving in the xy plane with constant acceleration has a velocity of $\mathbf{v}_i = (3.00\hat{\mathbf{i}} - 2.00\hat{\mathbf{j}})$ m/s and is at the origin. At $t = 3.00$ s, the particle's velocity is $\mathbf{v} = (9.00\hat{\mathbf{i}} + 7.00\hat{\mathbf{j}})$ m/s. Find (a) the acceleration of the particle and (b) its coordinates at any time t.

Q17/ A ski-jumper leaves the ski track moving in the horizontal direction with a speed of 25.0 m/s, as shown in Figure. The landing incline below him falls off with a slope of 35.0°. Where does he land on the incline?



Q18- A pilot of mass m in a jet aircraft executes a loop-the loop, as shown in Figure (a). In this maneuver, the aircraft moves in a vertical circle of radius 2.70 km at a constant speed of 225 m/s. Determine the force exerted by the seat on the pilot **(A)** at the bottom of the loop and **(B)** at the top of the loop. Express your answers in terms of the weight of the pilot mg.



Answer: **(A)** $n_{bot} = 2.91mg$ **(B)** $n_{top} = 0.913mg$

Q 20/ A man whose weight is 0.80 kN is standing upright. By approximately how much is his femur (thighbone) shortened compared with when he is lying down? Assume that the compressive force on each femur is about half his weight (Figure). The average cross-sectional area of the femur is 8.0 cm2 and the length of the femur when lying down is 43.0 cm.

Solution The strain is proportional to the stress:

$$\frac{F}{A} = Y\frac{\Delta L}{L}$$

Solving this equation for ΔL gives

$$\Delta L = \frac{F/A}{Y} L$$

From Table 10.1, Young's modulus for a femur *in compression* is:

$$Y = 9.4 \times 10^9 \text{ Pa}$$

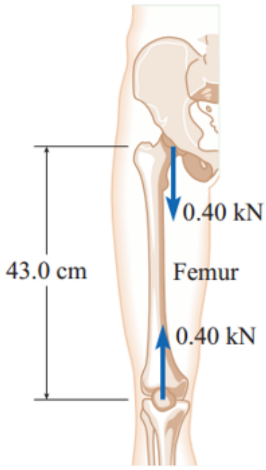
We need to convert the cross-sectional area to m^2 since 1 Pa = 1 N/m^2:

$$A = 8.0 \text{ cm}^2 \times \left(\frac{1 \text{ m}}{100 \text{ cm}}\right)^2 = 0.00080 \text{ m}^2$$

The force on each leg is 0.40 kN, or 4.0×10^2 N. The length change is then

$$\Delta L = \frac{F/A}{Y} L = \frac{(4.0 \times 10^2 \text{ N})/(0.00080 \text{ m}^2)}{9.4 \times 10^9 \text{ Pa}} \times 43.0 \text{ cm}$$

$$= 5.3 \times 10^{-5} \times 43.0 \text{ cm} = 0.0023 \text{ cm}$$



Strategy A change in length of the femur involves a strain. After finding the stress and looking up the Young's modulus, we can find the strain using Hooke's law. We assume that each femur supports *half* the man's weight.